SANITARY SCIENCE

AS APPLIED TO THE

Public Health

OF

SIOUX FALLS,

BY

S. A. BROWN, M. D.

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The following paper was first read as an essay before the Humboldt Club of this city on the evening of the 27th of April, 1885. The club deeming the paper a very timely as well as able one on a matter of general public concern, passed a resolution, in accordance with which a committee was appointed to attend to its publication. Acting under that resolution, the committee has issued the paper in pamphlet form, and hopes that it will secure the attention to which the subject and the carefulness of treatment entitle it.

Sioux Falls, May 15, 1885

W. J. Skillman,
E. G. Smith,
H. T. Root,
Committee.

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By S. A. BROWN, M. D.

MR. PRESIDENT:—Sanitary science has been defined by Dr. Mapothers as "An application of the laws of physiology and pathology to the maintenance of the life and health of communities, by means of those agencies which are in common and constant use." This department of science has of late years received so strong an impulse that many suppose it to be a new invention, but history tells us that anciently the health of the general population was often the subject of legislation. Among the Jews the preservation of the physical well being of the nation was, of old, a part of the religion; and nowhere can we find a better sanitary code than that of the Bible.

The Greeks were quite alive to the necessity of sanitary legislation; and the ruins of Roman sewers are still a wonder. In the Roman Empire a medical council was appointed in each town, whose duty it was to attend to the public health. As Christianity spread in Europe, however, it came, by some misconception of doctrine, to be believed that all diseases were sent by God as a scourge, either to punish the wicked or to purify the good—and that any scientific effort to prevent disease was directed entirely in opposition to the will of God. While the good monks and friars devoted themselves to feeding the hungry, clothing the naked, and instituting hospitals, they entertained no idea of the possible prevention of disease. They never attempted to impress upon their followers the importance of drainage, ventilation, pure and abundant water, etc.: but when an epidemic arose it was supposed to be a manifestation of God's special anger; and it would have been

impossible to make them understand that it was the natural result of prolonged disregard of the laws of nature. There can be no doubt that the frequency and fatality of epidemics, in the middle ages, were in a great measure due to unhealthy habitations. The houses were usually closely packed in crowded streets, and were often built for purposes of defence at a sacrifice of ventilation, drainage, lighting, etc. They builded high their ramparts, they made strong their battlements, their gates were bravely guarded against the human foe, but grim visaged Pestilence stalked boldly through those narrow streets, and laid low a hundred victims where one was destroyed by the hostile army. Their only hope in these days was to live in the open country. It might be in hovels, but these were built so open that the wind played freely through them, their excretions were scattered upon the earth like that of beasts and birds, and the earth absorbed and purified them; their water was from a spring; but when they crowded into cities and towns they illustrated clearly how men poison themselves and each other.

Dr. Farr has given an account of the death rate in England and Wales twenty years ago, and he has found that it is in direct proportion to the density of the population. Where the number of inhabitants per square mile was:

106	the annual death rate per 1000 was			-	17
186	"	"	"	-	19
379	"	"	"	-	22
1,178	"	"	"	-	25
4,499	"	"	"	-	28
12,357	"	"	"	-	32
64,823	"	"	"	-	39

The nearer people live to each other the shorter is the average duration of life.

Where the average proximity of residents is:					
147	yards,	the mean	duration of life is	45	years.
137	"	"	"	45	"
97	"	"	"	40	"
46	"	"	"	35	"
28	"	"	"	32	"
17	"	"	"	29	"
7	"	"	"	26	"

But sanitary science has demonstrated that by means of proper measures vigilantly enforced, the duration of life can be brought up in the most crowded cities to a level with that of the open country.

"God made the country," healthy, "Man made the town," and he is guilty of a crime if he do not have it also healthy.

The first steps in Christian lands, for the improvement of the public health, appear to have been taken in England

during the eighteenth century. Under a proper system of soil drainage ague was eradicated from extensive marshy districts; scurvy was by the use of lime juice almost blotted out of the list of diseases which proved most fatal to sailors; and vaccination, incomparably the greatest discovery yet made in this department of science was the crowning achievement of the century.

In the last forty years, or so, people in many lands have begun to see the importance of prevention of disease, and have adopted measures directed to that object with the happiest results.

It is shown by statistics that each time the cholera has left its native shores to make incursions into the less congenial climate of Europe and America, its ravages have been less and less disastrous, and we know that during the last two years it has confined itself, or been confined to the filthiest cities in Europe and Africa. This is a significant fact which should teach us to look with intelligent interest upon the advancement of sanitary science wherever made, and also to watch with jealous scrutiny any and every attempt at encroachment upon our own sanitary condition, and make each of us, as a disciple of progress, an advocate to spread with religious zeal the gospel of cleanliness.

To show the benefit of sanitary reform, it is stated in the Quarterly Journal of Science, January 1868, that Sandown in the Isle of Wight, which is thoroughly drained and well supplied with pure water, has an annual death rate of 11 per 1,000, while in contrast is taken the village of Child's Hill in the parish of Hendon, in which there is no efficient drainage, and where open cesspools, connected with privies often overflow into the ditches and discharge their contents in the river Brent. Here out of a population of 1,000 there were 70 deaths, mainly from typhoid fever.

In the year 1865, the English government employed Dr. Buchanan to ascertain the amount of benefit to public health, that had been derived from works of sanitary improvement—especially in drainage and water supply—that had already been completed. From his report which is fraught with much valuable information we learn among other things that typhoid fever has very much diminished with the ample supply of good water, the abolition of cesspools, by draining, etc. In Salisbury, Stratford, Croyden and Merthyr the annual death rate from typhoid has diminished 75, 67, 63 and 60 per cent. respectively, and in all the towns examined there was great diminution except where the system was not properly carried out. In the town of Worthing there was increase of the fever, but it was ascertained that on the side of the water tower of that town a shed containing the engine which performs

the double duty of distributing the water to the houses, and the sewage to the land. To enable this to be effected there are two wells within fifty feet of each other sunk in a porous soil, one for the reception of the sewage, and the other for the drinking water. "No arrangement for the propagation of typhoid" says the doctor "could have been more ingeniously devised."

He had not of course seen the ingenious arrangement recently made in Sioux Falls.

Dr. Buchanan found almost as much diminution in the death rate of consumption, in those localities where the soil had undergone any considerable drying by means of the drains.

"Cholera epidemic," says he "appear to have been rendered practically harmless in the towns examined."

"It cannot" says Mr. Simon a high English sanitary authority, "be too distinctly understood that the person who contracts cholera in this country is *ipso facto* demonstrated, with almost absolute certainty, to have been exposed to excremental pollution; that what gave him cholera was the contagion of cholera discharged from another's bowels; that, in short, the diffusion of cholera among us depends entirely upon the numberless filthy facilities which are let to exist, especially in our larger towns for the fouling of earth, and air, and water, and thus, secondarily, for the infection of man with whatever contagion may be contained in the miscellaneous outflowings of the population.

"Cholera, ravaging here at long intervals," continues the same high authority "is not nature's only retribution for our neglect in such matters as are in question. Typhoid fever and much endemic diarrhoea, it is true, called winter cholera) are, as I have often reported, incessant witnesses to the same deleterious influences: typhoid fever, which annually kills from 15,000 to 20,000 of our population, and diarrhoea which kills many thousands before. The mere quantity of this wasted blight is terrible to contemplate, and the misery which the waste is caused, is surely nothing less than shameful. It is to be hoped that as education advances, this sort of thing will come to seem that so much preventable death will not always be accepted as a fate: that for a population to be thus poisoned by its own excrement will some day be deemed intolerable and intolerable."

Mr. Simon deals with the death rate alone; and it is that the proportion of cases of typhoid to its deaths, and we have a grand annual total of 240,000 persons who lie many weeks upon a bed of suffering, are put to incalculable expense and are unfit for any kind of employment for months.

Dr De Wolf, [illegible] of Health of Chicago, in a paper before the Public Health Association, Nov. 1883, states that the town of Pullman, Ill., where the ideal of sanitary science has been realized, in every respect except that of situation, the town lying in a low marshy district almost on a level with the water of the lake, has an annual death rate of less than seven per 1,000 population — a rate which if kept up would make the average duration of life there three score and ten! The water is brought from five miles away, and is placed in every house. The sewage is removed to a farm near by, and itself returns 6 per cent on the cost of the sewage system.

Amongst all the diseases to which we in this region are liable, there is probably none so clearly preventable and so confessedly irremediable, as typhoid fever, and I desire to show how it is caused to the end that, at least in epidemic form, it may be kept from here in future.

I will begin with extracts from Dr. Hurley's article in Reynold's System of Medicine. "Dr. William Budd most strongly insists that the essence of typhoid fever is contained in the bowel discharges of the patient.

"The occupants of a farm house are attacked with typhoid fever, and the only discoverable cause is an overflowing cesspool from which putrescent matterings sink into, and saturate the soil in which the well supplying the house is excavated.

"The accumulated or pent up sewage of a town, escapes into the subjacent soil, within and about it, sinking into the wells and defiling the drinking water, and an outbreak of typhoid fever follows.

"Dr. Lead, editor of the Medical and Surgical Journal reports the case of a village where out of 318 157 inhabitants were attacked, and he says that the cause of the disease was the entire want of good fresh water, and the use of corrupted water. In 1858 a severe outbreak of typhoid fever occurred in Bedford, and there was every reason to believe that it was due to fecal matter soaking into the wells from the numerous cesspools of the town. Simon, report to privy council 1868. Early in October, 1847 typhoid fever broke out almost simultaneously in three houses in a cottage terrace in Clifton. The houses were far apart in the terrace and there was little or no intercourse between the families. The inhabitants of these thirteen houses drew their drinking water from a well situated at one end of the terrace. The remaining 21 houses were supplied with water from another source and all escaped. Dr. Wm. Budd, Lancet. 1859

"Other instances of the direct association of typhoid fever with contaminated well water may be found in the Simon report to the privy council in 1865.

Dr. Ballard and others have reported several instances in which outbreaks of typhoid fever in London and elsewhere have been traced to a close coincidence with the distribution of milk furnished to a number of families from the same dairies. The contamination of the milk by foul water has been inferred, and the existence of typhoid fever near the inculpated dairies has been shown. British Medical Journal 1870; Lancet, April 1873; August, 1873."

F. T. Roberts, M. D., B. Sc., M. R. C. P.: "There is abundant evidence that typhoid fever is infectious. It is most important to understand clearly how the disease is conveyed. There is very little danger from merely coming into the vicinity of typhoid patients. Indeed the probability is that the malady cannot be transmitted in this way, and medical men or nurses rarely take it from attending a patient. It is in the bowel discharges that the poison is chiefly contained, and by their agency the disease is propagated. The atmosphere may become impregnated with the emanations from the excreta, either because the latter are thrown into some open space, or because the water closets, privies, sewers, etc., are imperfect, and they may thus find their way into the system.

"Water is, however, the great channel by which the poison is conveyed, and numerous epidemics and endemics as well as sporadic cases of typhoid fever have been traced to some special water supply. The materials may soak through the soil from cesspits, or from being merely thrown upon the ground, and thus obtain access into wells the water of which is used for drinking purposes, or they may find their way into cisterns through waste pipes. Within a recent period it has been clearly proved, also, that milk is not uncommonly the vehicle by which the typhoid poison reaches the system."

Dr. Burdette, of the Sanitary Institute of Great Britain, in his excellent work on Cottage Hospitals, says: "At the village of Tollesbury, in Essex, bad drainage, impure water, and other insanitary evils had existed for years but the returns show few cases of fever prior to the outbreak to which I refer. In autumn 1877 a case of typhoid fever was brought from a neighboring town. What followed? Several other cases soon appeared in the same block of houses where the first case occurred. It was noticeable that the children were the chief sufferers, and a careful investigation which we made on the spot convinced us that the new cases were caused by the absence of disinfectants, and by the careless casting of the stools into an open pit at the back of the cottages. Although a country village the garden space was very limited, and the children were in the habit of playing around the pit and well at the back of the cottages. Stools, for the most part not disinfected, by being cast into the open ash-pit practically con-

[illegible] typhoid in this instance is to an infectious disease. It is the actions which are highly dangerous to healthy persons. No one we believe disputes this fact at the present day."

Prof. Hartshorn of Philadelphia, in an article on Water Supply (Our Homes) says: "At one of the New Jersey watering places, a few years ago, there occurred a number of cases of typhoid fever. All those attacked were residents in houses supplied by driven wells from the ground water. All those who used rain water for drinking escaped. Of the danger of injury to health from polluted water," says the distinguished writer, "it is hardly possible to say too much. In one cholera epidemic in London, six hundred deaths were traced to the use of a single pump. Typhoid fever has been repeatedly, nay, many times known to affect whole families who resorted to a well for a common supply while others in the same neighborhood using different water were not attacked. Worse yet, perhaps, seems to be the subtlety with which organic poison may be conveyed by water through milk in dairymen's supplies. Several times this has happened in London and elsewhere in England. In one instance, so far as appeared, the only mode of contamination was by the milk pans at the dairy being washed in water from a stream into which leakage had occurred from a neighboring privy. At another time, several well-to-do families, one of them a physician's, were affected with typhoid fever. It was found out that they were all supplied with milk by a company which furnished milk from several dairies. At last it was ascertained that cases of fever occurred only in those families to whom had been sent milk from one particular dairy, and a local cause of contamination of its water supply was also traced."

"Streams and rivers," proceeds the professor, "[illegible] the world over to the greater number of [illegible] their drinking water. They have the advantage of copiousness, facility of access, and movement, which [illegible] with the air. But they are liable to contamination on account of their exposure to solid and liquid refuse and waste of all kinds. Worst for the danger are small, shallow, slow streams, running through or by large towns or villages. Organic matter constitutes the [illegible] impurity of streams and rivers. Worst of all is [illegible] material sewage from human habitations. Since the [illegible] causes of human diseases are very subtle, whether they consist of 'disease germs' or not, what we know of the morbid transporting power of water should make us very cautious about using water for drinking or cooking into which drainage or sewage from human habitations can ever enter."

Dr. Henry B. Baker of the Michigan Board of Health,

has made a valuable report "On the Relation of Typhoid Fever and Low Water in Wells," which is based upon statistics laboriously gathered from all parts of the state. The facts are graphically laid before the reader in a series of diagrams: "Exhibiting correspondence in time and place between unusually low water in wells, and the occurrence of typhoid fever in Michigan during the years 1878-82 inclusive." Of 21 towns reported in the diagrams for 1881 but one shows typhoid fever unaccompanied by low water in the wells. Having clearly established a causal relation between these facts, the author proceeds to show how wells that contain but little water are most likely to have it contaminated by sewage from adjacent cesspools and privy vaults, while the small amount of water contained in the wells renders the poisonous solution all the more concentrated and dangerous.

Many facts are stated to prove that the disease is caused by bad drinking water rather than impure air; and the author believes that the typhoid germ is one that cannot thrive except in solutions of decaying organic matter.

It is stated that the town of Muskegon in 1880 was afflicted with the scourge during every month in the year, and that on investigation it was found that the water supply was derived from a ravine on the banks of which many privies were located.

A case was cited by Dr. Baker, where one hundred and seven cases of typhoid fever were traced to a dairy, and it was there found that the outbreak was immediately preceded by infection of the water, used at the dairy, by typhoid stools. He states that there were reported in Michigan 7,957 deaths, from 1867 to 1882 and says: "nearly every one of those 8,000 lives were sacrificed either through ignorance or culpable neglect; for there is nothing more clearly proved in relation to disease than that typhoid fever is entirely preventable."

"On the 4th of February last," says the British Medical Journal, of May 8, 1879, "representations were made to the local government board that a sudden outbreak of typhoid fever had occurred at Caterham. *Two days later* Dr. Thorne commenced his inquiry, finding that up to that date forty-seven cases of the disease had occurred within a fortnight. They were found to be spread over a very wide area, and the houses attacked belonged to no special class, both rich and poor having suffered. It was at once apparent that the disease could not have been conveyed to the affected houses by means of any general system of sewers common to the district, for, as a rule, the majority of the houses were drained into separate cesspools [illegible] into the soil. There was also no possibility that there could have been any common cause of infection in connection with the prevailing means of [illegible] be-

[illegible] with regard to such dis-
[illegible] of the houses in which the disease appeared
[illegible] with water closets, a considerable number
[illegible] which were apparently well trapped and ventilated.
Others had closets which were fitted with a trap and pan
[illegible] into a sspool, and though these closets were
[illegible] a source of nuisance, owing to the absence of any
flushing apparatus, yet they were all situated out of doors.
Others again were provided with common privies, and a
[illegible] earth closets.

"The possibility of the infection having been communicated by means of a milk supply was next inquired into and it was ascertained that thirty-three of the houses affected received their milk from at least five different and completely independent dairies, and that at the remaining two private cows were kept.

"It was also evident that personal infection could not in any way have led to the outbreak. Further there was no history of any recent prevalence of typhoid fever at Caterham. It was stated that the locality for some years had been remarkably free from the disease, and during the twelve months preceding the outbreak, only one, isolated, imported case could be heard of.

"With regard to the water supply, it was ascertained that out of a total of 568 houses in Caterham 419 were provided with water from the mains of the Caterham Water-works Company, the remaining 139 derived their supply from local wells, or from rain water tanks and barrels. Of the 97 persons attacked from January 19 to February 2, 45 resided in houses where the water of the Caterham Water-works Company was in use, a circumstance, which, having regard to other points already adverted to, indicated a likelihood that this water had been the means by which the infection had been conveyed. This view received confirmation when it was ascertained that the two remaining patients who resided on premises where private wells were in use, had, owing to the nature of their employment, not only been in the habit of spending the day at houses to which the company's water was laid on, but had admittedly drunk the water. Moreover, at the Caterham lunatic asylum, with two thousand inmates, and at the Caterham barracks, where five hundred soldiers were quartered, the water supply for both of which was a deep well belonging to the Metropolitan Asylums Board, not a single case had occurred to that date during the whole course of the epidemic. Whilst these inquiries were going on information was received of a similar epidemic at Pedhill, which is about eight miles distant from Caterham, and differs from it in several material respects, lying on the lower green sand instead of on the chalk, and being provided with a modern and efficient system of sewers. Here the epidem-

ic had commenced at the same time as that at Caterham, and it was found that during the first fortnight of the outbreak 91 out of 96 persons attacked drew their water from the mains of the Caterham company, which also supplied Redhill. Reigate town which forms a part of the sanitary district in which Redhill is situated, but which has a different water supply, entirely escaped. And this and other circumstances detailed by Dr. Thorne point clearly enough to the water supplied by the Caterham Company as the source of the mischief.

"This being so the next step was to discover in what way the poison of typhoid fever could have had access to the water. Here Dr. Thorne met at first with some difficulty, until he made inquiry as to any illness amongst the workmen who were engaged in making an adit from one of the two existing wells of the company up to a new bore, which was being sunk about ninety feet distant. It was there found that one of the men had been ailing while at work, and a lengthened examination of him made it apparent that, during the time he was engaged in the adit he was suffering from a mild form of typhoid fever. For the purposes of his argument, Dr. Thorne finds it necessary to give in considerable detail the symptoms of this man's illness especially as to his copious diarrhœa; but it will be sufficient for us to say that the man's evacuations passed into the water in the adit, and were thus distributed all over the company's system and that this is so is amply borne out by the occurrences which followed. If the stools of this man, who began to be ill on January 5th and continued at work till the 20th, could by any means have found their way into the water of the well in which he had been working, and being typhoid stools, could have led to the development of the poison of the disease in the well the effect on the water consumers ought to have been noticed within about ten days to two weeks after the date when the diarrhœa first came on. And this, in effect is precisely what did take place the epidemic having commenced on January 19th and 20th, in Caterham and Redhill respectively. Now, we know, from ample experience that typhoid fever is produced, and that with the maximum of certainty when the specific evacuations of the disease are consumed by a population. Again, it is a matter of experience that where typhoid fever has been conveyed through water, about a fortnight has to elapse between the distribution of the water and the occurrence of the disease in the community served by it. But a fortnight after January 5th is the very day when the first case of fever occurred, and during the fortnight following the disease became widely spread throughout Caterham and Redhill: the distribution of the fever being limited, as has been shown to the houses supplied by the Caterham company. Up to

the 20th of February the disease continued to attack exclusively those exposed to the water. After this it became more diffuse as might have been expected.

"The total number of cases was 352 with 21 deaths. That such a total should be the consequence of the act of one man is, it must be confessed, not a very encouraging subject for thought, but there is some comfort to be got from the fact that the exciting cause was temporary, and unforeseen, and that every possible remedial measure was at once taken."

SIOUX FALLS EPIDEMIC

Now, a few words in regard to the epidemic of typhoid fever recently prevalent in Sioux Falls. There had been, to my knowledge only a few cases of typhoid fever in the city during the twelve months before the time to which I refer, and most of them were imported. During the months of November and December, 1884, much complaint was made of a severe and persistent form of diarrhoea which had settled particularly upon the people in certain hotels. It was so general and so severe as to become the subject of constant remark, and to be frequently mentioned in the local papers. The name "winter cholera" was given to it. Daily on the streets and in the hotels we were asked to account for it. I endeavored to clear up its cause, and particularly questioned the water supply; but I could get no sufficient data of a reliable character upon which to base a conclusion, although all the cases were in persons who habitually or occasionally drank the hydrant water. Many of them said that whenever they touched the hydrant water it made them ill.

On the 18th of December, 1884, a case of typhoid fever occurred in the Commercial House, the patient remaining there one week and being removed on Christmas day. This patient's dejections went at once through the sewer into the river, and as we now know were pumped into the water mains regularly. About the first of January, just two weeks from the date of the beginning of this attack, cases of fever began to be developed in those houses which used the hydrant water. The disease spread rapidly. By the end of January we could no longer fail to see that it had become epidemic. There were cases at many of the hotels, at the jail and elsewhere, but no law-cases could be heard of where people drank only from wells. On the third day of February, growing alarmed at the rapid spread of the disease, and finding by the method of exclusion that the only agency capable of spreading the disease, common to all the cases was the drinking water,

furnished by the water works, an agency which, as we have seen, has been the usual, nay, almost exclusive medium of diffusion of typhoid epidemics that have hitherto been traced to their origin, the conviction was forced upon me that the source of supply of the water works had in some way become polluted. I published my conclusions in the daily papers with the grounds on which I based them, and no one will say, in view of the foregoing facts, that I could have acted differently.

Notwithstanding the magnitude of the interests involved, and the efforts made by the superintendent of the water works, not one item of proof was advanced to [illegible] my position. There were physicians in the city who ridiculed the idea, but they had no rebutting evidence to bring. If they had can any one believe that the water company would not at once have published it and thus vindicated the purity of its supply?

Meanwhile citizens, becoming alive to the importance of clearing up a charge so terrible, investigated the matter, and men of the highest standing boldly declared that although the company had published it in the papers that they derived their supply of water from a large well in which there was a living spring of pure water, they found that no water had been taken out of the well belonging to the waterworks since winter began, and that there appeared to be no connection between this well and the system whatever. And finally the superintendent of the water works admitted in my presence to the city council that the company was in the constant habit of pumping water into its mains and distributing it for drinking purposes to the unsuspecting people of Sioux Falls, from a point in the river on the same side and a few yards below the open mouth of a sewer which drained a hotel where typhoid fever was raging fiercely; thus [illegible] my judgment in a manner appalling to contemplate.

I have collected an account of the cases in this epidemic as far as I conveniently could, and the result of my investigation has amply borne out my first conclusion. Out of forty-two cases that have come under my professional observation there is only one in which the patient did not either live or work, or often visit, where the water of the company was habitually used. [illegible] about nine of the cases, one hundred and [illegible] in number, about which I have made inquiry. Of the remaining nine, one was the principal of the Baptist college, two were laborers, [illegible] were young persons who were in the habit of frequenting the skating rink, and are said often to have gone to the restaurants when through skating and taken refreshments, presumably drinking the hydrant water which was there in use. One case was not reported.

Professor Bartholow, in his [illegible] of Medicine, page 7[illegible], says: "The average duration of the incubation period (that length of time between taking the poison into the system and the development of the disease) in typhoid fever, may be stated at three weeks, although it may be as short as one, and as long as four." Now just two weeks after the day on which [illegible] in the Commercial house, to which I have referred, began the first case to [illegible] this epidemic [illegible] was attacked at the Messenger hotel on New Year's day, and just four weeks after the day on which my warning appeared in our daily paper the last [illegible] case in my practice occurred on the fourth of March. That is two weeks from the time the poison began to be consumed by the people the fever began to be developed, and four weeks after the poison ceased to be consumed the fever ceased to be developed.

In view, then, of the foregoing facts, shall we permit water to be foisted upon us, if it is not entirely above suspicion? Shall we be content to accept the simple assurance that we are to have pure water, and again receive it from a point in a mill pond, in our little, slow, shallow river, just below a host of privies and sewers?

Shall we not doggedly insist that only pure and wholesome water can be distributed to our population? Shall we not doggedly insist that no water about which there is a shadow of doubt, shall be served to the guests of the city at the hotels which entertain them? Shall we not doggedly insist that the works shall be so constructed as to make it impossible for the company ever to get water into the mains that could in any way, in the smallest degree be [illegible] by human excrement?

No one can possibly realize, more fully than I, how [illegible] the perfection of our sanitary conditions is on our water works system, which shall at all times supply us with an abundance of wholesome water. [illegible] we but do our duty by positively and persistently [illegible] water from the best attainable source only, [illegible] the community, the authorities and the company will [illegible] and obtain the best water within reach.

I need not discuss the question of obtaining, for domestic use, water from the Cascade mill pond. It is fouled by numberless privies and sewers, and its motion is only [illegible] enough to carry all polluting material to the dam. If all the sewers and privies were removed from its banks, there would still be the local ground water from a large portion of the city which empties into the mill pond, where there is no motion to purify it, so that unwholesome water would still be the inevitable result.

The water in the river above the mill pond, where it [illegible] and [illegible] to [illegible], the water in every part of the town, and if it were

not possible to obtain pure water, then I should emphatically advocate this source; but I am sure that you will all agree with me when I say that water with a maximum of purity can assuredly be obtained by sinking a well at the foot of the ridge which separates the populous portion of the city from Covell's lake. Bore deeply, excluding the surface water and the local ground water, until you reach a line drawn from the level of the water in the river to that of Covell's lake, and there, or thereabouts you will reach the general ground water of the region, and will obtain an inexhaustible supply which is always pure and is unaffected alike by rains and droughts. Let there be no compromise of the right way. Let no interests adopt our minds but the interest of Sioux Falls. Her enemies are sickness and death, her friends are health and life; pure water gives the one, corrupted water the other.

It has frequently been repeated in the course of this lecture that the great means whereby men poison themselves and each other is the excrement. I will therefore proceed, briefly, to outline the dangers from this source which appear to threaten this community, and endeavor to point out the methods by which these dangers may be averted.

The mode of excrement disposal, as practiced by a large body of house-holders in this town, is to dig a hole in the ground a short distance from the drinking well and the cellar, and place a privy over it. In this hole accumulates, from year to year, a putrifying mass of the most poisonous kind known of organic matter, and putrescent leachings from this mass saturate the earth of the building lot, carrying, besides the poison which is inseparable from all excrement, all the contagions that may be contained in the stools of such persons as may have been suffering from infectious diseases, and thus fouling the drinking well, and also often the cellar, and through it the air in the house. There are many parts of the town, on the hills as well as on the levels, where the local ground water lies so near the surface that whenever there is a rainy season, the earth becomes so water logged, and drenched that the water in the well rises, until one can dip it out with a cup, and the cellar and privy are flooded; and thus the excrement in the privy well is dissolved, and it soaks into the drinking well and the cellar. The physicians of the city and the older residents can all testify that in these regions typhoid fever has been a frequent visitor for years. In future it must become more so. Let no man deceive himself. Even if there were no privy pits on the premises, water in such places would be unwholesome, with them it becomes a source of much danger: but if a typhoid stool get into the privy the infection is certain, sooner or later, to reach a victim through the drinking water.

In this city during the past winter, hundreds of persons with typhoid fever have been pouring out, for weeks, a steady flow of highly infectious discharges. We cannot hope that all those discharges have been completely disinfected. The germ of this disease is so prolific in favorable soil, that one typhoid evacuation cast into a privy will speedily infect the whole mass therein contained. There is every likelihood that a number of these privies will soon infect the adjacent wells, especially if shallow, and thus institute new sources of fever.

Let us, then, drink no more water from wells which may be corrupted by drainage from a privy! Let us no longer be parties to the fouling of earth and water with sewage! Let us no longer permit our families daily to visit a spot so vile, so loathsome, so treacherous, so abhorrent to decency, so dangerous to health! Let us rise up united and with one voice condemn the cesspit in every form; and banish it from the face of our fair land forever; and make it a reproach, an offense, a disgrace to use it longer amongst us. What shall we do? We must drain. Wherever the earth is water logged drainage must be instituted, for, besides the great danger from excremental poisoning, we have other great dangers caused by wet foundations. Consumption, pneumonia, rheumatism and a host of other afflictions thrive on wet foundations. These foundations must be drained. There is scarcely any doubt that the city will adopt and enforce a system of sewers for the more populous portion of the town, at an early day. The necessity for it is so obvious that the newspapers have taken it up, and it seems that we now only wait for definite plans before we begin. Undoubtedly if there is to be no drainage provided for in the thickly populated portions of Phillips avenue and Main street we can expect nothing but sickness.

But for those houses which are out of the reach of all possible sewer connections, we must adopt the system which hitherto has proved to be the best of all, namely disinfection and removal.

Rich, arable earth, is for this purpose the best disinfectant known. To be effectual the earth must be both fresh and dry. Next to this in value is sifted ashes. Sand or clay are of little use. Much can be done with chemical disinfectants, but nothing keeps the closet so free from odor as rich dry earth. Two pounds will suffice to deodorize one stool. Removal at short intervals should be provided for by the city.

The most approved plan, at present followed, seems to be to have a small light box under the seat of the privy, arranged so as to be readily accessible and easily handled by two men, who empty it into a cart, disinfect and replace it. Persons who do not thoroughly disinfect being subject

to fine, and if necessary prosecuted against as a nuisance.

"Nothing" says Professor Hartshorn, "is more effectual in annulling the influence of contaminated water than *boiling* it before using." Many a time it has happened that, when bad water produced a local epidemic of typhoid fever, all the tea and coffee had been drunken, the water cold, while those who only took it in the form of tea and coffee have escaped. This was the case, for example, at Burlington, N. J., in 1870, where, as stated by Dr. L. Conte, thirty cases of typhoid fever occurred within two weeks from contamination of the drinking reservoir by leakage from a privy vault. None of the servants of the house, who drank only tea and coffee, and almost never cold water were attacked, while the boarders, often thirsty drank cold water freely between meals; and all the cases were among them.

I should not have ventured to address you upon a subject of such importance as that of sanitary science, were it not that it seems to me that there is an amount of indifference in this community to many of the most emphatic precepts, so great, that it can only be explained by assuming want of knowledge of its principles. I have therefore endeavored to place certain facts before you in such convincing form as to demonstrate clearly the extreme necessity of a wider knowledge of such matters in the community. And if I have succeeded in only creating the desire which shall kindle an interest in the subject here I am abundantly paid.

Book taken apart, leaves de-acidified with magnesium bi-carbonate. Leaves supported with lens tissue on both sides. New all-rag end paper signatures, unbleached linen hinges. Rebound in quarter linen with all rag paper sides. September 1975.

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